

Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) EP 0 750 929 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:  
02.01.1997 Bulletin 1997/01

(51) Int. Cl.<sup>6</sup>: A63H 30/00

(21) Application number: 96304780.8

(22) Date of filing: 28.06.1996

(84) Designated Contracting States:  
BE CH DE ES FR GB IT LI NL

(72) Inventor: Ishimoto, Zenichi  
Katsushika-ku, Tokyo (JP)

(30) Priority: 28.06.1995 JP 162309/95

(74) Representative: Ajello, Michael John

(71) Applicant: NIKKO Co., Ltd.  
Tokyo (JP)

207 Moss Lane

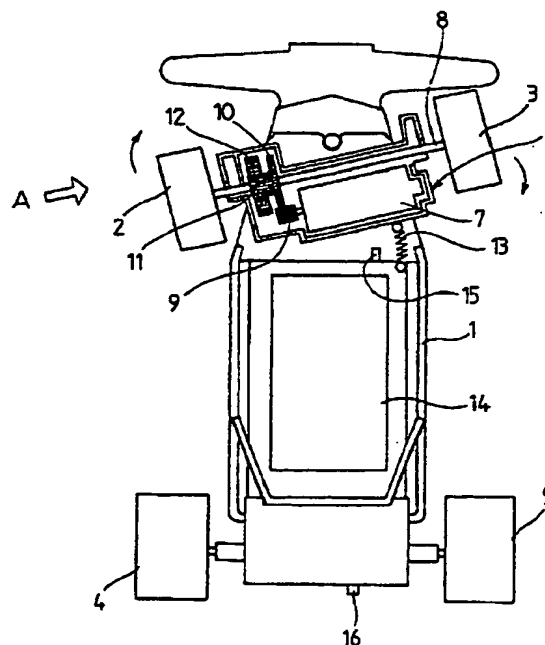
Bramhall Stockport Cheshire SK7 1BA (GB)

(54) Radio controlled toy car with an improved steering system

(57) The present invention provides a steering system provided on a chassis (1) of a toy car comprising the following elements. A rotatable steering plate (6) is rotatably provided on the chassis (1) so as to rotate in a horizontal plane by a predetermined maximum angle toward left and right directions from a longitudinal center axis of the chassis (1). A spring member is provided on the chassis (1) and mechanically connected to the rotatable steering plate (6) at its a position spaced apart from the longitudinal center axis of the chassis (1) for forcing the rotatable steering plate (6) to rotate and tilt toward one of the left and right directions from the longitudinal center axis of the chassis (1). A steering motor (7) is provided on the chassis (1) for generating a rotation power and the steering motor (7) having a motor shaft. A rotary shaft (8) is provided on the chassis (1). A transmission system mechanically connects the motor shaft and the rotary shaft (8) for transmitting the rotation power generated by the steering motor (7) into the rotary shaft (8). A first wheel (3) is so mechanically connected to a first end of the rotary shaft (8) that the first wheel (3) is allowed to rotate freely from the rotary shaft (8). A second wheel (2) is mechanically connected to a second end of the rotary shaft (8). The second wheel (2) has a clutch mechanism so operating that if the steering motor (7) is driven, then the rotation power is transmitted to the second wheel (2) and thus the second wheel (2) is driven whereby the rotatable steering plate (6) is forced to direct in parallel to the longitudinal center axis of the chassis (1). If, however, the steering motor (7) is not driven, then the rotation power generated by the steering motor (7) is not transmitted to the second wheel (2) and thus the second wheel (2) is not driven and does not rotate or rotates by inertia freely from the rotary shaft (8), whereby the rotatable steering plate (6) is forced to rotate and tilt toward the one of the left and right directions from the longitudinal center axis of the

chassis (1).

FIG. 1



EP 0 750 929 A2

## Description

The present invention relates to a radio-controlled toy car, and more particularly to an improved steering system provided in a radio-controlled toy car.

In recent years, the steering system of the radio-controlled toy car has become complicated because of recent tendency to pursue various and complex motions such as rapid turning motion in order to attract a great deal of user's attentions. This tendency has also made a signal transmitter complicated so that the signal transmitter has, for example, a plurality of control levers and one or more push-switches for control the steering operation and traveling in forward and reverse directions as well as traveling speed.

Needless to say, it is required that complex internal mechanisms including complicated steering systems are provided on a chassis of the toy car or accommodated in a body thereof. This leads to an increase in manufacturing cost of the radio-controlled toy car. This also makes it difficult for children to operate the radio-controlled toy car.

In the above circumstances, the inventor challenged to go against the recent fashion as described above to provide a simple radio-controlled toy car set at a suitable price by reduction in manufacturing cost thereof for enabling users to purchase it cheap as well as easily operable to children for amusing and attracting them.

Accordingly, it is an object of the present invention to provide a simple radio-controlled toy car set at a suitable price by reduction in manufacturing cost thereof for enabling users to purchase it cheap.

It is a further object of the present invention to provide a simple radio-controlled toy car easily operable to children for amusing and attracting them.

The above and other objects, features and advantages of the present invention will be apparent from the following descriptions.

The present invention provides a steering system provided on a chassis of a toy car comprising the following elements. A rotatable steering plate is rotatably provided on the chassis so as to rotate in a horizontal plane by a predetermined maximum angle toward left and right directions from a longitudinal center axis of the chassis. A spring member is provided on the chassis and mechanically connected to the rotatable steering plate at its a position spaced apart from the longitudinal center axis of the chassis for forcing the rotatable steering plate to rotate and tilt toward one of the left and right directions from the longitudinal center axis of the chassis. A steering motor is provided on the chassis for generating a rotation power and the steering motor having a motor shaft. A rotary shaft is provided on the chassis. A transmission system mechanically connects the motor shaft and the rotary shaft for transmitting the rotation power generated by the steering motor into the rotary shaft. A first wheel is so mechanically connected to a first end of the rotary shaft that the first wheel is allowed

to rotate freely from the rotary shaft. A second wheel is mechanically connected to a second end of the rotary shaft. The second wheel has a clutch mechanism so operating that if the steering motor is driven, then the rotation power is transmitted to the second wheel and thus the second wheel is driven whereby the rotatable steering plate is forced to direct in parallel to the longitudinal center axis of the chassis. If, however, the steering motor is not driven, then the rotation power generated by the steering motor is not transmitted to the second wheel and thus the second wheel is not driven and does not rotate or rotates by inertia freely from the rotary shaft, whereby the rotatable steering plate is forced to rotate and tilt toward the one of the left and right directions from the longitudinal center axis of the chassis.

The present invention also provides a radio controlled toy car comprising as follows. A chassis is provided and body provided on the chassis. A driving motor is provided for driving a driving shaft which connects a pair of driving wheels for traveling the radio controlled toy car. A rotatable steering plate is rotatably provided on the chassis so as to rotate in a horizontal plane by a predetermined maximum angle toward left and right directions from a longitudinal center axis of The chassis. A spring member is provided on the chassis and mechanically connected to the rotatable steering plate at its a position spaced apart from The longitudinal center axis of the chassis for forcing the rotatable steering plate to rotate and tilt toward one of the left and right directions from the longitudinal center axis of the chassis. A steering motor is provided on the chassis for generating a rotation power and the steering motor having a motor shaft. A control unit is provided on the chassis for controlling operations of the steering motor. A rotary shaft is provided on the chassis. A transmission system mechanically connects the motor shaft and the rotary shaft for transmitting the rotation power generated by the steering motor into the rotary shaft. A first wheel is so mechanically connected to a first end of the rotary shaft that the first wheel is allowed to rotate freely from the rotary shaft. A second wheel is mechanically connected to a second end of the rotary shaft. The second wheel has a clutch mechanism so operating that if the steering motor is driven, then the rotation power is transmitted to the second wheel and thus the second wheel is driven whereby the rotatable steering plate is forced to direct in parallel to the longitudinal center axis of the chassis. If, however, the steering motor is not driven, then the rotation power generated by the steering motor is not transmitted to the second wheel and thus the second wheel is not driven and does not rotate or rotates by inertia freely from the rotary shaft, whereby the rotatable steering plate is forced to rotate and tilt toward the one of the left and right directions from the longitudinal center axis of the chassis.

Preferred embodiments according to the present invention will be described in detail with reference to the accompanying drawings.

FIG. 1 is a plane view illustrative of a whole internal

mechanism including an improved steering system of a novel radio-controlled toy car in a preferred embodiment according to the present invention.

FIG. 2 is a view illustrative of disassembled left-front wheel parts included in an improved steering system of a novel radio-controlled toy car in a preferred embodiment according to the present invention.

FIG. 3 is a front view illustrative of a control signal transmitter which transmits radio-control signals to a novel radio-controlled toy car for controlling an improved steering system thereof in a preferred embodiment according to the present invention.

FIG. 4 is a block diagram illustrative of configurations of a control unit loaded on a chassis of a novel radio-controlled toy car in a preferred embodiment according to the present invention.

FIG. 5A is a front view illustrative of a structure of a left-front wheel, when the steering motor is driven, included in an improved steering system of a novel radio-controlled toy car in a preferred embodiment according to the present invention.

FIG. 5B is a front view illustrative of a structure of a left-front wheel, when the steering motor is in a stand-still, included in an improved steering system of a novel radio-controlled toy car in a preferred embodiment according to the present invention.

The present invention provides a steering system provided on a chassis of a toy car comprising the following elements. A rotatable steering plate is rotatably provided on the chassis so as to rotate in a horizontal plane by a predetermined maximum angle toward left and right directions from a longitudinal center axis of the chassis. A spring member is provided on the chassis and mechanically connected to the rotatable steering plate at its a position spaced apart from the longitudinal center axis of the chassis for forcing the rotatable steering plate to rotate and tilt toward one of the left and right directions from the longitudinal center axis of the chassis. A steering motor is provided on the chassis for generating a rotation power and the steering motor having a motor shaft. A rotary shaft is provided on the chassis. A transmission system mechanically connects the motor shaft and the rotary shaft for transmitting the rotation power generated by the steering motor into the rotary shaft. A first wheel is so mechanically connected to a first end of the rotary shaft that the first wheel is allowed to rotate freely from the rotary shaft. A second wheel is mechanically connected to a second end of the rotary shaft. The second wheel has a clutch mechanism so operating that if the steering motor is driven, then the rotation power is transmitted to the second wheel and thus the second wheel is driven whereby the rotatable steering plate is forced to direct in parallel to the longitudinal center axis of the chassis. If, however, the steering motor is not driven, then the rotation power generated by the steering motor is not transmitted to the second wheel and thus the second wheel is not driven and does not rotate or rotates by inertia freely from the rotary shaft, whereby the rotatable steering plate is forced to

rotate and tilt toward the one of the left and right directions from the longitudinal center axis of the chassis.

It is available that the spring member provides an extension force to push a rear side portion of the rotatable steering plate in a front direction.

Alternatively, it is also available the spring member provides a contraction force to pull a rear side portion of the rotatable steering plate in a rear direction.

It is preferable that the transmission system is a transmission gear system comprising a plurality of gears.

It is advantageously available that the clutch mechanism of the second wheel comprises as follows, A disk like plate is mechanically connected to the rotary shaft so that the disk like plate rotates freely from the rotation of the rotary shaft. The disk like plate has an outside surface on which an annular ring ridge is coaxially fixed and the disk like plate is provided at a center portion thereof with an opening through which the rotary shaft penetrates so that the disk like plate can rotate freely from the rotary shaft. A holding member is mechanically fixed to the second end of the rotary shaft and being positioned on an outside face of the disk like plate so that the holding member holds the disk like plate to the rotary shaft but allows the disk like plate to rotate freely from the rotary shaft. The holding member has an elliptic cylinder shape and extending outwardly. A convex portion cylindrically shaped is provided on the holding member. The cylindrically shaped convex portion is coaxially positioned on the holding member so that the convex portion extends from the holding member outwardly. The convex portion having a smaller diameter than not only a major axis but also a minor axis of the holding member. A cum is elliptically and cylindrically shaped and having two recessed portions to form stepped portions at opposite ends on a major axis of the cum. The stepped portions faces in a direction opposite to the rotation direction of the second wheel the anti-clockwise direction. The cum has an opening elliptically shaped at its center portion. The opening has a major axis tilted by a smaller angle than a half of right angle from the major axis of the cum in the direction opposite to the rotation direction of the second wheel. The major axis of the opening is sufficiently longer than the major axis of the holding member and a minor axis of the opening is just larger than the minor axis of the holding member so that the opening receives the holding member to form a gap between the opening and the holding member. A cylindrically shaped annular wheel member is opened at inside whilst closed at outside by a disk-like plate member with a hole at its center portion so that the hole receives the convex portion. A ridged portion extends along on a radially inner surface of the cylindrically shaped annular wheel member and toward a radially inside direction. The ridged portion so varies in height that the ridged portion has a stepped face which may just fit to any of the stepped portions and the height of the ridged portion is gradually reduced to zero in the rotation direction of the second wheel.

The present invention also provides a radio controlled toy car comprising as follows. A chassis is provided and body provided on the chassis. A driving motor is provided for driving a driving shaft which connects a pair of driving wheels for traveling the radio controlled toy car. A rotatable steering plate is rotatably provided on the chassis so as to rotate in a horizontal plane by a predetermined maximum angle toward left and right directions from a longitudinal center axis of the chassis. A spring member is provided on the chassis and mechanically connected to the rotatable steering plate at its position spaced apart from the longitudinal center axis of the chassis for forcing the rotatable steering plate to rotate and tilt toward one of the left and right directions from the longitudinal center axis of the chassis. A steering motor is provided on the chassis for generating a rotation power and the steering motor having a motor shaft. A control unit is provided on the chassis for controlling operations of the steering motor. A rotary shaft is provided on the chassis. A transmission system mechanically connects the motor shaft and the rotary shaft for transmitting the rotation power generated by the steering motor into the rotary shaft. A first wheel is so mechanically connected to a first end of the rotary shaft that the first wheel is allowed to rotate freely from the rotary shaft. A second wheel is mechanically connected to a second end of the rotary shaft. The second wheel has a clutch mechanism so operating that if the steering motor is driven, then the rotation power is transmitted to the second wheel and thus the second wheel is driven whereby the rotatable steering plate is forced to direct in parallel to the longitudinal center axis of the chassis. If, however, the steering motor is not driven, then the rotation power generated by the steering motor is not transmitted to the second wheel and thus the second wheel is not driven and does not rotate or rotates by inertia freely from the rotary shaft, whereby the rotatable steering plate is forced to rotate and tilt toward the one of the left and right directions from the longitudinal center axis of the chassis.

It is available that the spring member provides an extension force to push a rear side portion of the rotatable steering plate in a front direction.

Alternatively, it is also available the spring member provides a contraction force to pull a rear side portion of the rotatable steering plate in a rear direction.

It is preferable that the transmission system is a transmission gear system comprising a plurality of gears.

It is advantageously available that the clutch mechanism of the second wheel comprises as follows. A disk like plate is mechanically connected to the rotary shaft so that the disk like plate rotates freely from the rotation of the rotary shaft. The disk like plate has an outside surface on which an annular ring ridge is coaxially fixed and the disk like plate is provided at a center portion thereof with an opening through which the rotary shaft penetrates so that the disk like plate can rotate freely from the rotary shaft. A holding member is mechanically

fixed to the second end of the rotary shaft and being positioned on an outside face of the disk like plate so that the holding member holds the disk like plate to the rotary shaft but allows the disk like plate to rotate freely from the rotary shaft. The holding member has an elliptic cylinder shape and extending outwardly. A convex portion cylindrically shaped is provided on the holding member. The cylindrically shaped convex portion is coaxially positioned on the holding member so that the convex portion extends from the holding member outwardly. The convex portion having a smaller diameter than not only a major axis but also a minor axis of the holding member. A cum is elliptically and cylindrically shaped and having two recessed portions to form stepped portions at opposite ends on a major axis of the cum. The stepped portions faces in a direction opposite to the rotation direction of the second wheel the anti-clockwise direction. The cum has an opening elliptically shaped at its center portion. The opening has a major axis tilted by a smaller angle than a half of right angle from the major axis of the cum in the direction opposite to the rotation direction of the second wheel. The major axis of the opening is sufficiently longer than the major axis of the holding member and a minor axis of the opening is just larger than the minor axis of the holding member so that the opening receives the holding member to form a gap between the opening and the holding member. A cylindrically shaped annular wheel member is opened at inside whilst closed at outside by a disk-like plate member with a hole at its center portion so that the hole receives the convex portion. A ridged portion extends along on a radially inner surface of the cylindrically shaped annular wheel member and toward a radially inside direction. The ridged portion so varies in height that the ridged portion has a stepped face which may just fit to any of the stepped portions and the height of the ridged portion is gradually reduced to zero in the rotation direction of the second wheel.

A preferred embodiment according to the present invention will be described in detail with reference to the accompanying drawings, wherein an improved steering system is provided a novel radio-controlled toy car.

With reference to FIG. 1, a whole internal mechanism including an improved steering system of the radio-controlled toy car will be described. The radio-controlled toy car has a chassis 1 on which a control unit 14 is provided for controlling travels in forward and reverse directions and speed thereof. The rear end of the chassis 1 is provided with a driving motor container for containing a driving motor which has a rotary shaft connecting left and right rear wheels 4 and 5. At the rear side of the driving motor container, a power switch 16. On the chassis 1, a steering system is further provided in front of the control unit 14. The steering system is spaced apart from the control unit 14. The steering system has a rotatable steering plate 6 which is rotatably placed on the chassis 1 so that the rotatable steering plate 6 rotates in a horizontal plane by a predetermined maximum angle toward left and right directions from a

longitudinal center axis of the chassis 1. A right and rear portion of the rotatable steering plate 6 is mechanically connected with one end of a spring member 13 which extends toward the rear but has an opposite end mechanically fixed to the chassis 1 at its position in front of the front end of the control unit 14. The spring member 13 provides an extension force to push a right half of the rotatable steering plate 6 in the front direction so that the rotatable steering plate 6 is forced to rotate in accordance with the extension force of the spring member 13 so that the rotatable steering plate 6 be tilted by the predetermined maximum angle toward the right direction from the longitudinal center axis of the chassis 1.

On the rotatable steering plate 6, a steering motor 7 is provided, which has a rotary shaft extending from the left side of the steering motor 7. The steering motor 7 is placed under the control by the control unit 14. The rotary shaft is mechanically connected with a first steering gear 9 which rotates along with the rotary shaft in the same direction. A second steering gear 10 is engaged with the first steering gear 9 so that the second steering gear 10 rotates in a direction opposite to the rotary direction of the first steering gear 9. The second steering gear 10 is positioned in front of the first steering gear 9. The second steering gear 10 has a diameter much larger than the first steering gear 9 and thus the number of gear teeth of the second steering gear 10 is much larger than the first steering gear 9. A third steering gear 11 is coaxially and unitary fixed to the second steering gear 10 so that the third steering gear 11 rotates along with the second steering gear 10 in the same direction. The third steering gear 11 has a diameter smaller than the second steering gear 10 and thus the number of gear teeth of the third steering gear 11 is smaller than the second steering gear 10. A fourth steering gear 12 is engaged with the third steering gear 11 so that the fourth steering gear 12 rotates in a direction opposite to the rotary direction of the third steering gear 11. The fourth steering gear 12 is positioned below the third steering gear 11. The fourth steering gear 12 has a diameter much larger than the third steering gear 11 and thus the number of gear teeth of the fourth steering gear 12 is much larger than the third steering gear 11. The above first to fourth steering gears 9, 10, 11 and 12 are provided on a left part of the rotatable steering plate 6. The fourth steering gear 12 is mechanically fixed to a rotary shaft which connects left and right front wheels 2 and 3 so that the left front wheel 2 rotates along with the rotary shaft 8 whilst the right front wheel 3 rotates freely from the rotary shaft 8. This means that the rotation power is transmitted only to the left front wheel 2 but not transmitted to the right front wheel 3. The rotation power of the steering motor 7 is then transmitted via a transmission gear system comprising the first to fourth steering gears 9, 10, 11 and 12 to the rotary shaft 8 and further transmitted but only the left front wheel 2. The right front wheel 3 is free from the transmission of the rotation power of the steering motor

7. The rotary shaft 8 is also provided on the rotatable steering plate 6. When the rotatable steering plate 6 rotates in the horizontal plane within the predetermined maximum angle toward left and right directions from the longitudinal center axis of the chassis 1, then the rotary shaft 8 and the left and right front Wheels 2 and 3 also rotates along the rotatable steering plate 6 whereby the left and right front wheels 2 and 3 change in their direction along the rotatable steering plate 6.

Further, a stopper convex portion 15 is provided on the chassis 1 so that the stopper convex portion 15 is positioned at the right side from the longitudinal center axis of the chassis 1 and at the rear of the rear end of the rotatable steering plate 6 but in front of the front end of the control unit 14. The stopper convex portion 15 is positioned closer to the longitudinal center axis of the chassis 1 than the spring member 13. It is essential that the stopper convex portion 15 is so positioned that the rear end of the rotatable steering plate 6 bumps into the stopper convex portion 15 when the rotatable steering plate 6 is forced to rotate against the extension force of the spring member 13 so that the rotatable steering plate 6 be tilted by the predetermined maximum angle toward the right direction from the longitudinal center axis of the chassis 1.

FIG. 2 is illustrative of disassembled left-front wheel parts as follows. The left-front wheel 2 has a disk like plate 41 is mechanically connected to the rotary shaft 8 so that the disk like plate 41 rotates freely from the rotation of the rotary shaft 8. The disk like plate 41 has an outside surface on which an annular ring ridge 49 is coaxially fixed. The diameter of the annular ring ridge 49 is smaller than the disk like plate 41 so that a peripheral portion of the disk like plate 41 is positioned radially outside the annular ring ridge 49. The disk like plate 41 is provided at a center portion thereof with an opening through which the rotary shaft 8 penetrates so that the disk like plate 41 can rotate freely from the rotation of the rotary shaft 8. The left end of the rotary shaft 8 is mechanically fixed with a holding member 42 which is positioned on an outside face of the disk like plate 41 so that the holding member 42 holds the disk like plate 41 to the rotary shaft 8 but allows the disk like plate 41 to rotate freely from the rotation of the rotary shaft 8. The holding member 42 has an elliptic cylinder shape and extending toward the left side or the outside. Since the elliptically and cylindrically shaped holding member 42 is fixed with the left end of the rotary shaft 8, the holding member 42 is positioned at the center of the disk like plate 41. The holding member 42 is provided with a cylindrically shaped convex portion 50 which is coaxially positioned on the elliptically and cylindrically shaped holding member 42 so that the cylindrically shaped convex portion 50 extends from the elliptically and cylindrically shaped holding member 42 toward the outside direction or the left direction. The cylindrically shaped convex portion 50 has a smaller diameter than not only a major axis but also a minor axis of the elliptically and cylindrically shaped holding member 42. The left front

wheel 2 further has a cum 43 which is elliptically and cylindrically shaped and has two recessed portions to form stepped portions 45 at opposite ends on a major axis of the elliptically shaped cum 43. In the left-side view, the stepped portions 45 of the elliptically shaped cum 43 face in the anticlockwise direction. The elliptically shaped cum 43 also has an elliptically shaped opening 44 at its center portion, wherein the elliptically shaped opening 44 has a major axis tilted by a small angle from the major axis of the elliptically shaped cum 43 toward the clockwise direction in the left side view. The elliptically shaped opening 44 of the elliptically shaped cum 43 has a major axis sufficiently longer than the major axis of the elliptically and cylindrically shaped holding member 42 and a minor axis just smaller than the minor axis of the elliptically and cylindrically shaped holding member 42 so that the elliptically shaped opening 44 receives the elliptically and cylindrically shaped holding member 42 to form a gap between the elliptically shaped opening 44 and the elliptically and cylindrically shaped holding member 42. The gap is created by the difference in length of major axis between the elliptically and cylindrically shaped holding member 42 and the elliptically shaped opening 44. On the minor axis, the elliptically and cylindrically shaped holding member 42 fits to the elliptically shaped opening 44 of the elliptically shaped cum 43. The left front wheel 2 furthermore has a cylindrically shaped annular wheel member 46. An inside or right side circular edge of cylindrically shaped annular wheel member 46 is opened whilst an outside or left side circular edge of cylindrically shaped annular wheel member 46 is closed by a disk-like plate member which has a hole 48 at its center portion so that the hole 48 receives the cylindrically shaped convex portion 50. The cylindrically shaped annular wheel member 46 has a radially outer surface on which a tire 51 is provided and further a radially inner surface to define an inner space which accommodates the elliptically shaped cum 43 and the annular ring ridge 49. The annular ring ridge 49, however, fits to the radially inner surface of the cylindrically shaped annular wheel member 46. A ridged portion 47 is provided extending along on a half part of the radially inner surface of the cylindrically shaped annular wheel member 46. The ridged portion 47 varies in height in the radially inside direction so that the ridged portion 47 has a stepped face which just fits to the stepped portions 45 and the height of the ridged portion 47 in the radial direction is gradually reduced to zero from almost the same height as the stepped portion 45 of the elliptically shaped cum 43 in the anticlockwise direction in the left side view. The elliptically shaped cum 43 is rotatably received in the inner space of the cylindrically shaped annular wheel member 46 so that the elliptically shaped cum 43 is in contact with the ridged portion 47. The stepped face of the ridged portion 47 may face to the stepped portions 45 of the elliptically shaped cum 43.

FIG. 3 is illustrative of a control signal transmitter which transmits radio-control signals to a novel radio-

controlled toy car for controlling an improved steering system thereof. The control signal transmitter comprises a body of a circular shape with a motor driving push button 21 and an antenna 22. If the motor driving push button 21 is pushed, then a motor driving signal is transmitted from the antenna 22 to the radio-controlled toy car.

FIG. 4 is illustrative of configurations of the control unit 14 provided on the chassis 1. The control unit 14 is supplied with power by a battery 37. The control unit 14 has an antenna 31 for receiving the radio-control signal having been transmitted from the control signal transmitter illustrated in FIG. 3. The control unit 14 also has a super-regeneration receiver circuit 32 connected to the antenna 31 for receiving the control signal transmitted via the antenna 31. An amplifier 33 is electrically connected to the super-regeneration receiver circuit 32 for fetching the control signal from the super-regeneration receiver circuit 32 and amplifying the fetched control signal. A filter 34 is electrically connected to the amplifier 33 for fetching the amplified control signal from the amplifier 33 and filtering the same. A motor driving amplifier 35 is electrically connected to the filter 34 and also connected to the steering motor 7 for fetching the filtered control signal from the filter 34 and controlling the driving of the steering motor 7.

The following description will focus on the operation of the steering system. The power switch 16 is pushed and turn ON. Then, motor driving push button 21 is pushed to transmit the motor driving control signal to the control unit 14. The motor driving control signal is received by the antenna 31 and then transmitted through the super-regeneration receiving circuit to the amplifier 33 so that the motor driving control signal is amplified. The amplified motor driving control signal is then transmitted to the filter 34 so that the amplified motor driving control signal is filtered. The filtered motor driving control signal is then transmitted to the motor driving amplifier 35 so that the steering motor 7 provided on the steering system is driven under the control of the motor driving amplifier 35. When the steering motor 7 is driven, then the rotation power of the steering motor 7 is transmitted through the transmission gear system comprising the first to fourth steering gears 9, 10, 11 and 12 into the rotary shaft 8. As described above, the left front wheel 2 is so connected to the rotary shaft 8 that the left front wheel 2 rotates along with the rotary shaft 8, whilst the right front wheel 3 is so connected to the rotary shaft 8 that the right front wheel 3 rotates freely from the rotary shaft 8.

FIG. 5A is illustrative of a structure of the left-front wheel 2 when the steering motor 7 is driven and FIG. 5B is illustrative of the structure of the left-front wheel 2 when the steering motor 7 is in standstill. When the steering motor 7 is driven, then the left-front wheel 2 rotates along with the rotary shaft 8. When the steering motor 7 is in standstill, then the left-front wheel 2 rotates by inertia freely from the rotary shaft 8.

With reference to FIG. 5A, when the steering motor

7 is driven and the rotary shaft 8 rotates, then the elliptically and cylindrically shaped holding member 42 fixed to the end of the rotary shaft 8 rotates along with the rotary shaft 8. Since the elliptically and cylindrically shaped holding member 42 partially fits into the elliptically shaped opening 44 of the elliptically shaped cum 43, the rotation of the elliptically and cylindrically shaped holding member 42 causes a rotation of the elliptically shaped cum 43. The direction of the rotation of the left front wheel is the anticlockwise direction. The gap between the elliptically shaped opening 44 of the elliptically shaped cum 43 and the elliptically and cylindrically shaped holding member 42 allows the elliptically shaped cum 43 to move in relation to the elliptically and cylindrically shaped holding member 42 in a direction parallel to the longitudinal direction of the elliptically shaped opening 44 by a distance corresponding to the difference in length of major axis between the elliptically and cylindrically shaped holding member 42 and the elliptically shaped cum 43. Thus, the rotation of the elliptically shaped cum 43 generates a centrifugal force applied thereto whereby the elliptically shaped cum 43 moves in the direction parallel to the longitudinal direction of the elliptically shaped opening 44 by the distance corresponding to the difference in length of major axis between the elliptically and cylindrically shaped holding member 42 and the elliptically shaped cum 43. As a result, the elliptically and cylindrically shaped holding member 42 comes in contact with the end of the elliptically shaped opening 44 so that the elliptically shaped cum 43 comes positioned offset from the center of the cylindrically shaped annular wheel member 46. As a result, the stepped face of the ridged portion 47 just fits to one of the stepped portions 45 of the elliptically shaped cum 43 as well illustrated in FIG. 5A. The stepped portions 45 of the elliptically shaped cum 43 pushes, in the anticlockwise direction, the stepped face of the ridged portion 47 fixed the radially inner surface of the cylindrically shaped annular wheel member 46 whereby the cylindrically shaped annular wheel member 46 rotates in the anticlockwise direction. Since only the left front wheel 2 is driven by the steering motor 7 whilst the right front wheel 3 rotates freely from the rotation by the steering motor 7, the rotatable steering plate 6 is forced to rotate in a direction marked by a real arrow mark until the rotatable steering plate 6 is directed to the longitudinal direction of the chassis 1. As a result, the radio-controlled toy car goes straight on.

If the motor driving push button 21 of the control signal transmitter is push off, the transmission of the motor driving control signal is discontinued whereby the steering motor 7 comes in standstill and the rotation of the rotary shaft 8 is discontinued. The rotation of the elliptically and cylindrically shaped holding member 42 is also discontinued whereby the rotation of the elliptically shaped cum 43 is further discontinued. As a result, the centrifugal force having been applied to the elliptically shaped cum 43 disappears whereby the elliptically shaped cum 43 moves in the direction parallel to the

longitudinal direction of the elliptically shaped opening 44 by the distance corresponding to the difference in length of major axis between the elliptically and cylindrically shaped holding member 42 and the elliptically shaped cum 43. The cylindrically shaped annular wheel member 46 may rotate in the anticlockwise direction by inertia separately from the elliptically shaped cum 43 which has been in the standstill whereby the stepped face of the ridged portion 47 fixed the radially inner surface of the cylindrically shaped annular wheel member 46 is detached from the stepped portion 45 of the elliptically shaped cum 43. Since the tapered portion of the ridged portion 47 is directed to the anticlockwise direction in which the cylindrically shaped annular wheel member 46 rotates, the cylindrically shaped annular wheel member 46 may rotate freely from the elliptically shaped cum 43 having already been in the standstill. The rotatable steering plate 6 is forced by the extension force of the spring member 13 to rotate and tilt toward the left side by the predetermined maximum angle from the longitudinal direction of the chassis 1. As a result, the radio-controlled toy car turns left.

As modifications of the present invention, it is available that the spring member is to provide an diminishing force for pull the right rear end of the rotatable steering plate 6 so that the rotatable steering plate 6 is forced to tilt the right side by the predetermined maximum angle from the longitudinal center axis of the chassis 1. It is also available to provide the steering system which is connected to the rear wheels 4 and 5.

Whereas any further modifications of the present invention will be apparent to a person having ordinary skill in the art, to which the invention pertains, it is to be understood that embodiments as shown and described by way of illustrations are by no means intended to be considered in a limiting sense. Accordingly, it is to be intended to cover by claims all modifications which fall within the spirit and scope of the present invention.

#### Claims

1. A steering system provided on a chassis (1) of a toy car comprising:

a rotatable steering plate (6) being rotatably provided on the chassis (1) so as to rotate in a horizontal plane by a predetermined maximum angle toward left and right directions from a longitudinal center axis of the chassis (1) ; means being provided on said chassis (1) and mechanically connected to said rotatable steering plate (6) at its a position spaced apart from said longitudinal center axis of the chassis (1) for forcing said rotatable steering plate (6) to rotate and tilt toward one of said left and right directions from said longitudinal center axis of the chassis (1) ; a steering motor (7) being provided on said chassis (1) for generating a rotation power and



said steering motor (7) having a motor shaft;  
a rotary shaft (8) being provided on said chassis (1) ;

a transmission system mechanically connecting said motor shaft and said rotary shaft (8) for transmitting said rotation power generated by said steering motor (7) into said rotary shaft (8) ;

a first wheel (3) being so mechanically connected to a first end of said rotary shaft (8) that said first wheel (3) is allowed to rotate freely from said rotary shaft (8) ; and

a second wheel (2) being mechanically connected to a second end of said rotary shaft (8),

characterized in that said second wheel (2) has a clutch mechanism so operating that if said steering motor (7) is driven, then said rotation power is transmitted to said second wheel (2) and thus said second wheel (2) is driven whereby said rotatable steering plate (6) is forced to direct in parallel to said longitudinal center axis of said chassis (1), and if said steering motor (7) is not driven, then said rotation power generated by said steering motor (7) is not transmitted to said second wheel (2) and thus said second wheel (2) is not driven and does not rotate or rotates by inertia freely from said rotary shaft (8), whereby said rotatable steering plate (6) is forced to rotate and tilt toward said one of said left and right directions from said longitudinal center axis of the chassis (1).

2. The steering system as claimed in claim 1, characterized in that said forcing means comprises a spring member providing an extension force to push a rear side portion of said rotatable steering plate (6) in a front direction.
3. The steering system as claimed in claim 1, characterized in that said forcing means comprises a spring member providing a contraction force to pull a rear side portion of said rotatable steering plate (6) in a rear direction.
4. The steering system as claimed in claim 1, characterized in that said transmission system is a transmission gear system comprising a plurality of gears.
5. The steering system as claimed in claim 1, characterized in that said clutch mechanism of said second wheel (2) comprises:

a disk like plate (41) being mechanically connected to said rotary shaft (8) so that said disk like plate (41) rotates freely from the rotation of the rotary shaft (8), said disk like plate (41) having an outside surface on which an annular ring ridge is coaxially fixed and said disk like plate

(41) being provided at a center portion thereof with an opening through which said rotary shaft (8) penetrates so that the disk like plate (41) can rotate freely from said rotary shaft (8);

a holding member (42) being mechanically fixed to said second end of said rotary shaft (8) and being positioned on an outside face of said disk like plate (41) so that said holding member (42) holds said disk like plate (41) to said rotary shaft (8) but allows said disk like plate (41) to rotate freely from said rotary shaft (8), said holding member (42) having an elliptic cylinder shape and extending outwardly ;

a convex portion (50) cylindrically shaped being provided on said holding member (42), said cylindrically shaped convex portion (50) being coaxially positioned on said holding member (42) so that the convex portion (50) extends from said holding member (42) outwardly, said convex portion (50) having a smaller diameter than not only a major axis but also a minor axis of said holding member (42) ; a cum (43) being elliptically and cylindrically shaped and having two recessed portions to form stepped portions at opposite ends on a major axis of said cum (43), said stepped portions facing in a direction opposite to said rotation direction of said second wheel (2) the anticlockwise direction, said cum (43) having an opening elliptically shaped at its center portion, said opening having a major axis tilted by a smaller angle than a half of right angle from said major axis of said cum (43) in said direction opposite to said rotation direction of said second wheel (2), said major axis of said opening being sufficiently longer than said major axis of said holding member (42) and a minor axis of said opening being just larger than said minor axis of said holding member (42) so that said opening receives said holding member (42) to form a gap between said opening and said holding member (42) ;

a cylindrically shaped annular wheel member (46) being opened at inside whilst closed at outside by a disk-like plate member with a hole at its center portion so that said hole receives said convex portion (50) ; and

a ridged portion (47) extending along on a radially inner surface of said cylindrically shaped annular wheel member (46) and toward a radially inside direction, said ridged portion (47) so varying in height that the ridged portion (47) has a stepped face which may just fit to any of said stepped portions and the height of said ridged portion (47) is gradually reduced to zero in said rotation direction of said second wheel (2).

6. A radio controlled toy car comprising:



a chassis (1) ;

a body provided on said chassis (1) ;

a driving motor for driving a driving shaft which connects a pair of driving wheels for traveling said radio controlled toy car ;

a rotatable steering plate (6) being rotatably provided on the chassis (1) so as to rotate in a horizontal plane by a predetermined maximum angle toward left and right directions from a longitudinal center axis of the chassis (1) ; means being provided on said chassis (1) and mechanically connected to said rotatable steering plate (6) at its a position spaced apart from said longitudinal center axis of the chassis (1) for forcing said rotatable steering plate (6) to rotate and tilt toward one of said left and right directions from said longitudinal center axis of the chassis (1) ;

a steering motor (7) being provided on said chassis (1) for generating a rotation power and said steering motor (7) having a motor shaft ; a control unit being provided on said chassis (1) for controlling operations of said steering motor (7) ;

a rotary shaft (8) being provided on said chassis (1) ;

a transmission system mechanically connecting said motor shaft and said rotary shaft (8) for transmitting said rotation power generated by said steering motor (7) into said rotary shaft (8) ;

a first wheel (3) being so mechanically connected to a first end of said rotary shaft (8) that said first wheel (3) is allowed to rotate freely from said rotary shaft (8) ; and

a second wheel (2) being mechanically connected to a second end of said rotary shaft (8),

characterized in that said second wheel (2) has a clutch mechanism so operating that if said steering motor (7) is driven, then said rotation power is transmitted to said second wheel (2) and thus said second wheel (2) is driven whereby said rotatable steering plate (6) is forced to direct in parallel to said longitudinal center axis of said chassis (1), and if said steering motor (7) is not driven, then said rotation power generated by said steering motor (7) is not transmitted to said second wheel (2) and thus said second wheel (2) is not driven and does not rotate or rotates by inertia freely from said rotary shaft (8), whereby said rotatable steering plate (6) is forced to rotate and tilt toward said one of said left and right directions from said longitudinal center axis of the chassis (1).

7. The radio controlled toy car as claimed in claim 6, characterized in that said forcing means comprises a spring member providing an extension force to push a rear side portion of said rotatable steering

plate (6) in a front direction.

8. The radio controlled toy car as claimed in claim 6, characterized in that said forcing means comprises a spring member providing a contraction force to pull a rear side portion of said rotatable steering plate (6) in a rear direction.
9. The radio controlled toy car as claimed in claim 6, characterized in that said transmission system is a transmission gear system comprising a plurality of gears.
10. The radio controlled toy car as claimed in claim 6, characterized in that said clutch mechanism of said second wheel (2) comprises :

a disk like plate (41) being mechanically connected to said rotary shaft (8) so that said disk like plate (41) rotates freely from the rotation of the rotary shaft (8), said disk like plate (41) having an outside surface on which an annular ring ridge is coaxially fixed and said disk like plate (41) being provided at a center portion thereof with an opening through which said rotary shaft (8) penetrates so that the disk like plate (41) can rotate freely from said rotary shaft (8) ;

a holding member (42) being mechanically fixed to said second end of said rotary shaft (8) and being positioned on an outside face of said disk like plate (41) so that said holding member (42) holds said disk like plate (41) to said rotary shaft (8) but allows said disk like plate (41) to rotate freely from said rotary shaft (8), said holding member (42) having an elliptic cylinder shape and extending outwardly ;

a convex portion (50) cylindrically shaped being provided on said holding member (42), said cylindrically shaped convex portion (50) being coaxially positioned on said holding member (42) so that the convex portion (50) extends from said holding member (42) outwardly, said convex portion (50) having a smaller diameter than not only a major axis but also a minor axis of said holding member (42) ; a cum (43) being elliptically and cylindrically shaped and having two recessed portions to form stepped portions at opposite ends on a major axis of said cum (43), said stepped portions facing in a direction opposite to said rotation direction of said second wheel (2) the anticlockwise direction, said cum (43) having an opening elliptically shaped at its center portion, said opening having a major axis tilted by a smaller angle than a half of right angle from said major axis of said cum (43) in said direction opposite to said rotation direction of said second wheel (2), said major axis of said opening being sufficiently longer than said major

axis of said holding member (42) and a minor axis of said opening being just larger than said minor axis of said holding member (42) so that said opening receives said holding member (42) to form a gap between said opening and said holding member (42) ; 5

a cylindrically shaped annular wheel member (46) being opened at inside whilst closed at outside by a disk-like plate member with a hole at its center portion so that said hole receives said convex portion (50) ; and 10

a ridged portion (47) extending along on a radially inner surface of said cylindrically shaped annular wheel member (46) and toward a radially inside direction, said ridged portion (47) so varying in height that the ridged portion (47) has a stepped face which may just fit to any of said stepped portions and the height of said ridged portion (47) is gradually reduced to zero in said rotation direction of said second wheel (2). 20

25

30

35

40

45

50

55

FIG. 1

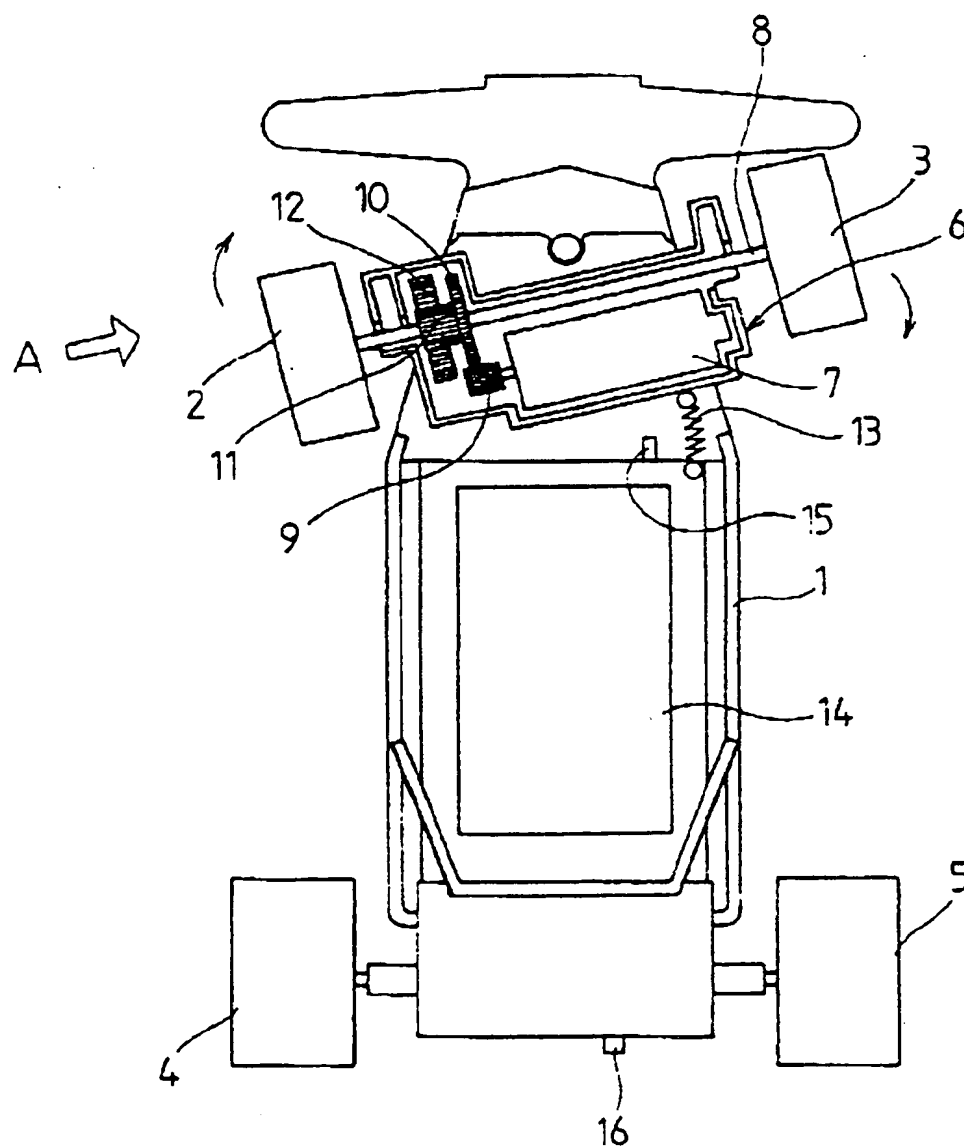


FIG. 2

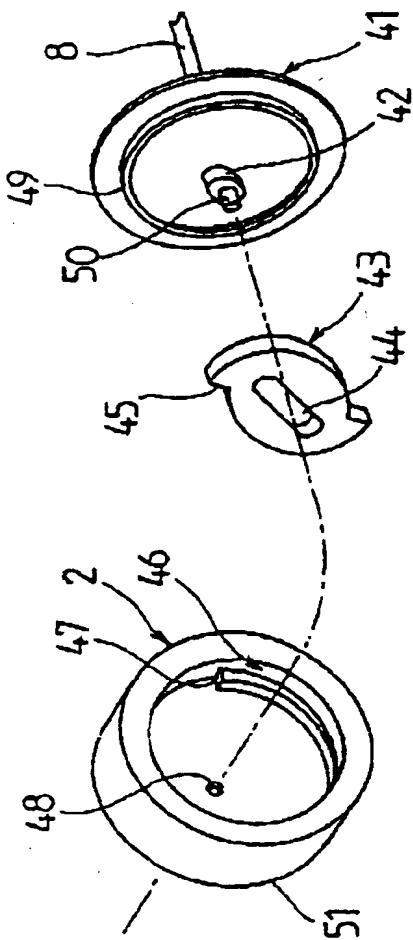


FIG. 3

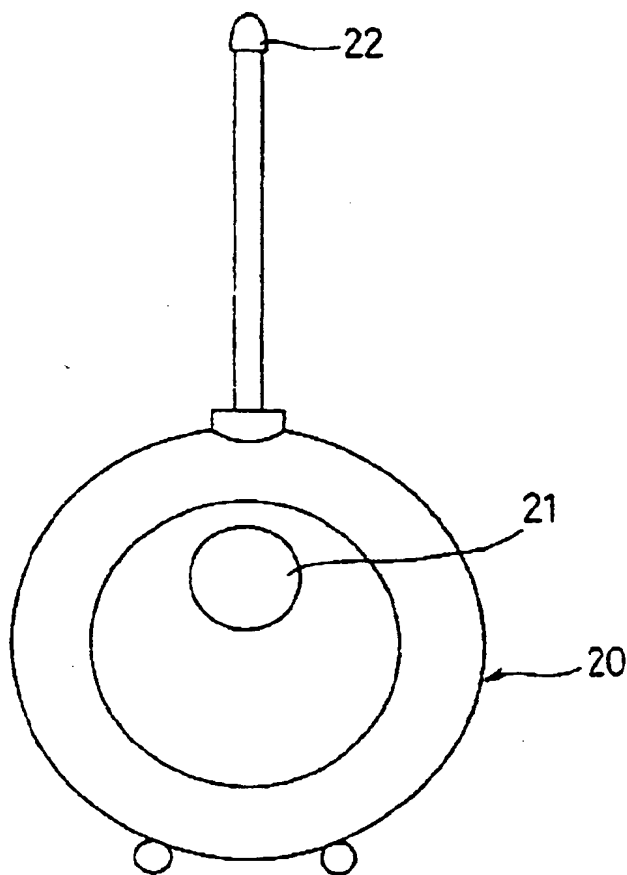


FIG. 4

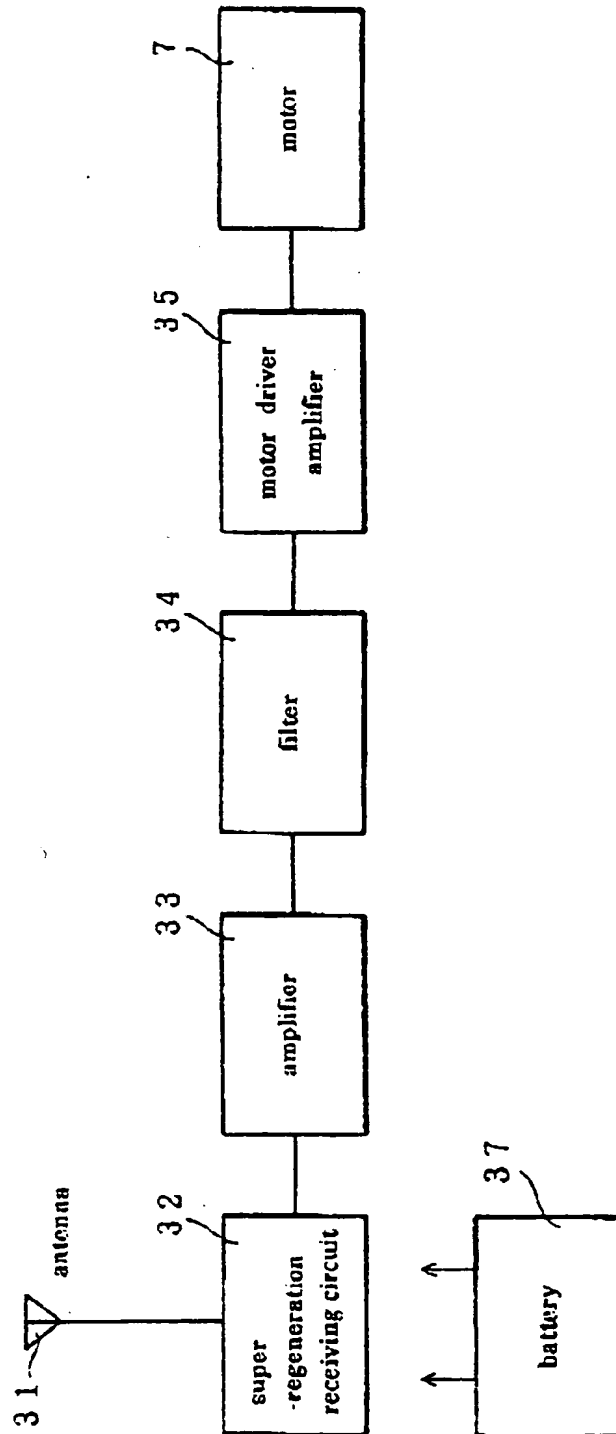


FIG. 5A

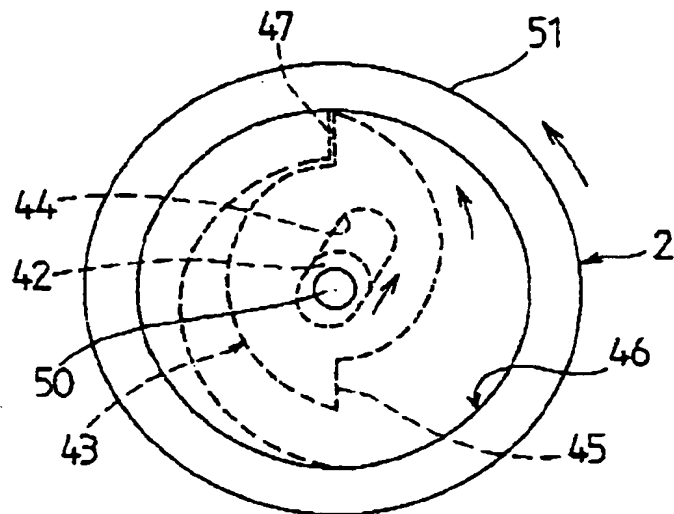
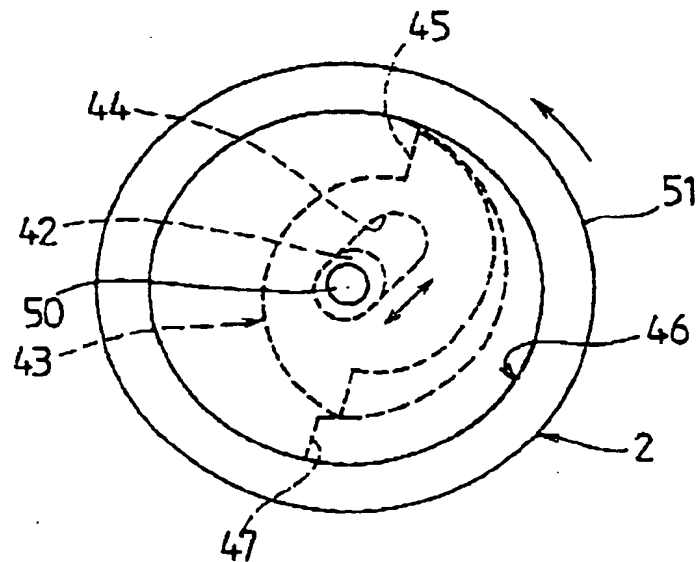


FIG. 5B





(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 750 929 A3

(12)

## EUROPEAN PATENT APPLICATION

(88) Date of publication A3:  
29.01.1997 Bulletin 1997/05

(51) Int. Cl.<sup>6</sup>: A63H 30/00, A63H 17/36

(43) Date of publication A2:  
02.01.1997 Bulletin 1997/01

(21) Application number: 96304780.8

(22) Date of filing: 28.06.1996

(84) Designated Contracting States:  
BE CH DE ES FR GB IT LI NL

(72) Inventor: Ishimoto, Zenichi  
Katsushika-ku, Tokyo (JP)

(30) Priority: 28.06.1995 JP 162309/95

(74) Representative: Ajello, Michael John  
207 Moss Lane  
Bramhall Stockport Cheshire SK7 1BA (GB)

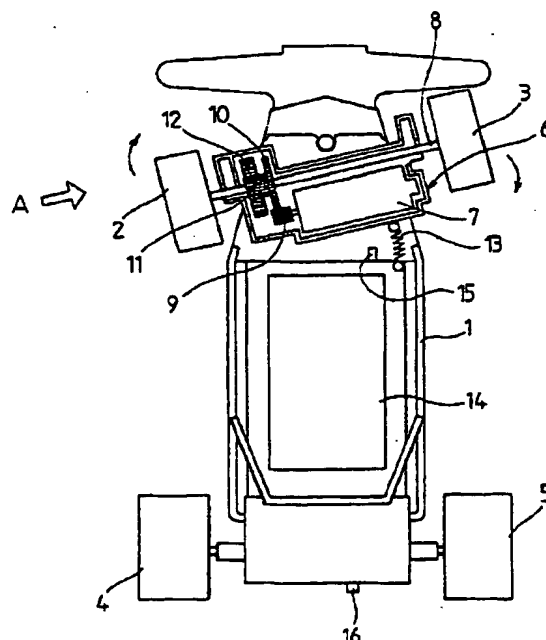
(71) Applicant: NIKKO Co., Ltd.  
Tokyo (JP)

## (54) Radio controlled toy car with an improved steering system

(57) The present invention provides a steering system provided on a chassis (1) of a toy car comprising the following elements. A rotatable steering plate (6) is rotatably provided on the chassis (1) so as to rotate in a horizontal plane by a predetermined maximum angle toward left and right directions from a longitudinal center axis of the chassis (1). A spring member is provided on the chassis (1) and mechanically connected to the rotatable steering plate (6) at its a position spaced apart from the longitudinal center axis of the chassis (1) for forcing the rotatable steering plate (6) to rotate and tilt toward one of the left and right directions from the longitudinal center axis of the chassis (1). A steering motor (7) is provided on the chassis (1) for generating a rotation power and the steering motor (7) having a motor shaft. A rotary shaft (8) is provided on the chassis (1). A transmission system mechanically connects the motor shaft and the rotary shaft (8) for transmitting the rotation power generated by the steering motor (7) into the rotary shaft (8). A first wheel (3) is so mechanically connected to a first end of the rotary shaft (8) that the first wheel (3) is allowed to rotate freely from the rotary shaft (8). A second wheel (2) is mechanically connected to a second end of the rotary shaft (8). The second wheel (2) has a clutch mechanism so operating that if the steering motor (7) is driven, then the rotation power is transmitted to the second wheel (2) and thus the second wheel (2) is driven whereby the rotatable steering plate (6) is forced to direct in parallel to the longitudinal center axis of the chassis (1). If, however, the steering motor (7) is not driven, then the rotation power generated by the steering motor (7) is not transmitted to the second wheel (2) and thus the second wheel (2) is not driven and does not rotate or rotates by inertia freely from the

rotary shaft (8), whereby the rotatable steering plate (6) is forced to rotate and tilt toward the one of the left and right directions from the longitudinal center axis of the chassis (1).

FIG. 1



EP 0 750 929 A3



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 4780

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	GB-A-1 581 243 (MASUDAYA) * page 2, line 122 - page 3, line 13; figures *	1,6	A63H30/00 A63H17/36
A	GB-A-1 498 775 (SHYOHEI SUDO) * figures 1,2 *	1,6	
A	US-A-4 213 270 (ODA) * figure 4 *	1,6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A63H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 4 December 1996	Examiner Lasson, C
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document</p> <p>T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 (01.92) (P6/C01)